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Safe Operation & Maintenance of Circuit Breakers and Switchgears

5 - 9 May 2025

Rome (Italy)

Safe Operation & Maintenance of Circuit Breakers and Switchgears

course code: C8103 From: 5 - 9 May 2025 Venue: Rome (Italy) - course Fees: 4500 Euro

The *conference*

Circuit breakers, fused switches and switchgear in the form of motor Control Centres (MCC) are necessary system items for the electrical control of electrical plant. The safe use of these devices and associated equipment requires correct initial selection, operation and maintenance. It is also necessary to have a detailed understanding of how these devices should be installed, the local substation and system ratings, and how the various breakers operate, in order to enable accurate troubleshooting and subsequent repair.

Safe Operation & Maintenance of Circuit Breakers and Switchgear will equip participants with new or refreshed skills to ensure that circuit breakers and switchgear are installed, operated safely and maintained in a fashion that ensures safe and stable operation. Also they will be able to identified faults and ensure the underlying causes are identified to reduce possible further failures.

The Goals

The objectives of this seminar are to present:

- Understanding of the operational characteristics of circuit breakers and switchgear.
- Understanding of troubleshooting procedures, as applied to circuit breakers and associated switchgear.
- Improved capability in the use of test equipment.
- Better understanding of failure modes and failure analysis as applied to fuses, circuit breakers and switchgear. In relation to air break, vacuum and SF6 devices.
- Refreshed awareness of electrical safety concerns within substations and control centres
- Ability to determine fault levels in substations

The Delegates

Safe Operation & Maintenance of Circuit Breakers and Switchgear is intended for:

- Electrical Engineers
- Electrical Supervisors
- Senior Electrical Technicians engaged in the operation, maintenance and troubleshooting, of circuit breakers, interruptive devices and switchgear control centres. The systems to be discussed will mainly fall within the voltage range 0.4 - 33kV. System calculations will be undertaken for typical industrial type installations. System calculations will be undertaken for typical industrial type installations.

The Process

The conference is conducted as modular lectures with encouragement for the participant to interact.

Case studies are included to illustrate typical system arrangements in the range of voltages from 400V up to 36kV. Delegates are requested to bring general details of their companies approach to substation design and type of equipment employed at the various voltage levels employed.

Drawings and plant ratings are useful.

Questions are welcomed throughout the course and during break sessions.

The Benefits

- Greater personal confidence in approaching working safely with power switchgear
- Understanding "competence" and Health and Safety at work
- Awareness of the fault level and fault currents within equipment
- Detailed understanding of the various interrupting mediums, air, vacuum and SF6
- Understanding protection, isolation and switching
- Appreciating the differences between earthing and bonding
- Understanding of the need to carry out appropriate maintenance, inspection, test and certification of installations, equipment and appliances in the range 0.4 - 36kV

Carefully selected examples and case studies will be used to illustrate the material being discussed and in particular, emphasis will be given to ensure that the material is appropriate to the organizations represented.

The Results

- A better understanding of the operational characteristics of circuit breakers and switchgear.
- A better understanding of troubleshooting procedures, as applied to circuit breakers and associated switchgear.
- An improved capability in the use of test equipment.
- A better understanding of failure modes and failure analysis as applied to fuses, circuit breakers and switchgear. In relation to air break, vacuum and SF6 devices.
- A refreshed awareness of electrical safety concerns within substations and control centres.

The Core Competencies

- Knowledge of types of switchgear and disconnectors
- Understanding of electrical systems and their load and fault requirements
- Overview of substation layouts and equipment from 0.4 - 36kV
- Health and Safety and equipment fault voltages during earth fault conditions
- Maintenance, inspection, testing and certification of switching plant
- Understanding electrical hazards, safe working distances and permits to work
- Recognition of unsafe situations
- Safe earthing of equipment during maintenance, lock outs and labels

The conference Content

The Technology of Circuit Breakers and Switchgear

- Typical substation arrangements and MCC's
- Definitions and terminology
- Fault level calculations
- Motor and generator fault contributions
- Low voltage equipment
- Medium voltage equipment
- High voltage equipment

- Name plate ratings - interpretation
- CT's and VT's
- Basic protection requirements
- Case studies

Operation of various types of interrupting equipment

- Fuses - motor starting types
- Fused switches
- Moulded case type breakers
- Air break switches
- Vacuum contactors - fused
- Vacuum circuit breakers
- SF6 puffer, rotating arc devices
- Special insulating requirements for 36kV
- Solid and gaseous insulation - problems!

The Operation and Maintenance of Circuit Breakers and Switchgear

The Use of Test Equipment

- Digital voltmeter (DVM)
- Oscilloscopes
- Megger
- Frequency meter
- Temperature probes/ IR pyrometers
- Ammeters
- Power meters
- Load banks
- Cable fault locators

Special Techniques

- NEC check lists to ensure the correct installation
- Troubleshooting of Electrical Equipment
- Methods
- Terminology
- Principles
- Special techniques
- Case studies/ examples
- Single line drawings
- Group exercises and case studies

The Interpretation and Use of Drawings

- Single-line electrical drawings
- Control schematics
- Basic generic wiring lists
- Name plate information
- Logic and standard symbols
- Step and touch potential?

The Development of a Job Plan

- Identification of the troubleshooting step-by-step sequence
- Procedure preparation
- Documentation
- Follow-up
- Safety considerations and training
- Case studies

The Identification and Repair of Problems/ Failures

- Common mode failures
- Phase imbalance - lost phase
- Phase sequence checkout
- Contact pitting/arcing - why?
- Load and fault rating
- Electronic component failure
- Fusing
- Switches
- Control circuits
- Ground faults - cable and busbar faults
- Case studies
- A review of Safety Requirements
- Area classifications
- NEC electrical codes
- Safety information